

Response to comments by Editor Farahnaz Khosrawi

We thank the editor for her comments on the revised manuscript. The suggestions to further improve the wording are greatly appreciated, and the manuscript was modified as follows (editors' comments in blue, responses in black).

P3, L45: "at altitudes" -> which altitudes? Is here something missing?

We agree that the initial wording "at altitude" is not very precise and have changed this to "at aircraft cruise altitudes of 8-13 km".

P7, L149: which average -> which are averaged

As "which are averaged" might be mistaken as a mathematical averaging, the wording was changed to "which represent an average mixing ratio over the sampling time of 30—240 s"

P10, L197: I am not sure if just writing "into" is correct here. Wouldn't it be better to write from "the northern hemisphere to the stratosphere" (thus to state from where these flew into the southern hemisphere).

"flights into the southern hemisphere" was changed to "flights with sections in the southern hemisphere". The same wording was used on P4, L53 and the caption of Fig. 3 and was changed there correspondingly.

P10, L219: "data from the HIPPO flight" -> also here I would suggest to more clearly write "data from the flight from the HIPPO campaign".

The wording "data from the HIPPO flight" (which should have been "flights") was changed to "data from the HIPPO missions".

P12, L230: Fig S1 -> Fig. S1

Corrected.

P13, L252: I would suggest to make to sentences. Thus fullstop after "here" and new sentence starting with "One" or to use a semicolon.

Changes as suggested.

P14, L273 and 278: Reference to Fig. S5 before Fig. S2. Supplementary figures should also be referenced in a consecutive order.

Corrected to references in consecutive order.

P15, L295: "the" before "reference time series" obsolete?

It seems appropriate to use "the" here to stress that there is one particular reference time series used.

P15, L313: Check sentence, something is wrong here. I would skip "As" and start the sentence "The results shown in Fig 6. indicate..." or "The time lag shown in Fig. 6 indicate..."

The wording has been changed to: "The results shown in Fig. 6 indicate that in particular emissions at southern latitudes might be too low. To test this, up to 28 % of emissions were taken out of the northern hemisphere extra-tropics (Box 0) and shifted southward into the tropics (Boxes 1 and 2)."

P17, L340: Also this sentence need to be checked. Something is wrong here, too. How can evaluating the lag time improve the results?

The MAD as a quantifier for the model-observation deviation can be evaluated based on time lags or based on mixing ratios. Here, we compare the improvement obtained for both. To make this more clear the sentence was reworded to:

"The value of $d(\text{MAD})_{\text{mixr}}$ improves to 0.18 ppt for this model setup. Evaluating the differences between modelled and observed lag times, $d(\text{MAD})_{\text{lag}}$ improves to 0.47 years compared to 1.95 years with the default transport scheme and unscaled emissions."

P18, L356 and L361: AGAGE box model already mentioned before introduced. Provide the details on model and the reference already in line 356.

L 356 has been changed and does not refer to the model anymore.

P19, L370: Check also this sentence and consider to split in several sentences or to better connect the text parts.

The lengthy passage was cut into several sentences and now reads: "To study the influence of the model transport scheme, a series of sensitivity runs was performed. Thereby better agreement was found with a 3.25% global emission increase relative to EDGAR 7 bottom-up emissions in combination with a southward shift of emissions and a modified transport scheme. The latter combined a weaker tropical transport barrier and thus faster transport into the southern hemisphere."

P19, L377: slower transport of what? Please be more precise.

Wording was extended to "slower southward transport".

Reference list: Please check, that the style is consequently done according to the Copernicus style. In some cases titles start all words with capital letters, in some cases the normal upper/lower case writing is used.

We've used to original upper/lower case writing used by the original journal and will change this during the final typesetting according to the recommendations from the language editing team.

In some cases subscripts for the chemical species as e.g. SF₆ are missing etc.

All missing subscripts have been corrected.

Further language simplifications:

P 3, L32: Split sentence to “Model results indicate that interhemispheric transport is asymmetric, with transport from the northern into the southern hemisphere being faster than vice versa. This influences the north-south gradient and interhemispheric transport times (Krol et al., 2018).

P 3, L45: mixing ratio -> mixing ratios

P3, L 47: Reworded to: “In particular tropical convection can rapidly bring air masses with elevated mixing ratios of SF₆ and other tracers to the upper troposphere, for example from the Asian monsoon region or over tropical Africa (e. g. Randel and Park, 2006; Schuck et al., 2010; Vogel et al., 2016; Thorenz et al., 2016). Convection over remote marine tropical regions, in contrast, results in an inflow of air with low mixing ratios of anthropogenic tracers. This also implies that the interhemispheric gradient of SF₆ could vary with longitude. This was observed for example for CH₄ in the upper troposphere during IAGOS-CARIBIC (In-Service Aircraft for a Global Observing System - Civil Aircraft for the Regular Investigation of the Atmosphere Based on an Instrument Container) and CONTRAIL (Comprehensive Observation Network for TRace gases by AirLiner) flights with sections in the southern hemisphere (Schuck et al., 2012).”

P5, L85: Dropped repetition of “series”.

P7,144: comma added

P9, L190: Sentence split into: “This value was derived as the average offset of the lowermost stratosphere with regard to the upper troposphere from the cross-tropopause gradient of the CARIBIC data set. Data from the northern hemisphere mid-latitudes with a potential temperature difference of 5 K above the thermal tropopause were used.”

P 10, L210: Removed “which corresponds to all upper tropospheric observations”

P14, L292: comma added

P15, L301 and 302 and 303: comma added